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(54) Rod-like article conveying and storage system

(57) A system is provided operable to receive cigarettes from a making machine 1, to store the cigarettes as a continuous bed, and to supply cigarettes to a packing machine 2. The system comprises two variable capacity conveyors 4,5 and an intermediate connecting conveyor 6. Cigarettes may be transferred at the intermediate conveyor to or from a shuttle carriage 11 which runs on a guide track extending to one or more similar systems.

Fig.1.

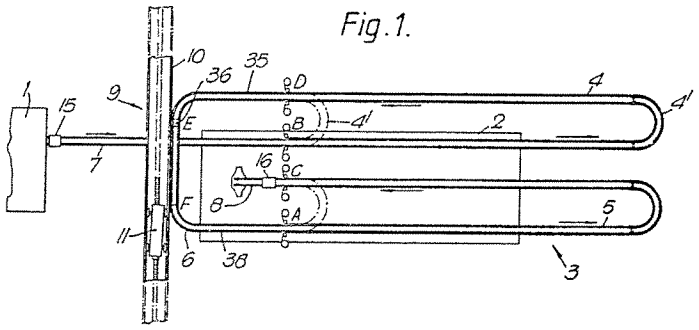

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Fig. 1.

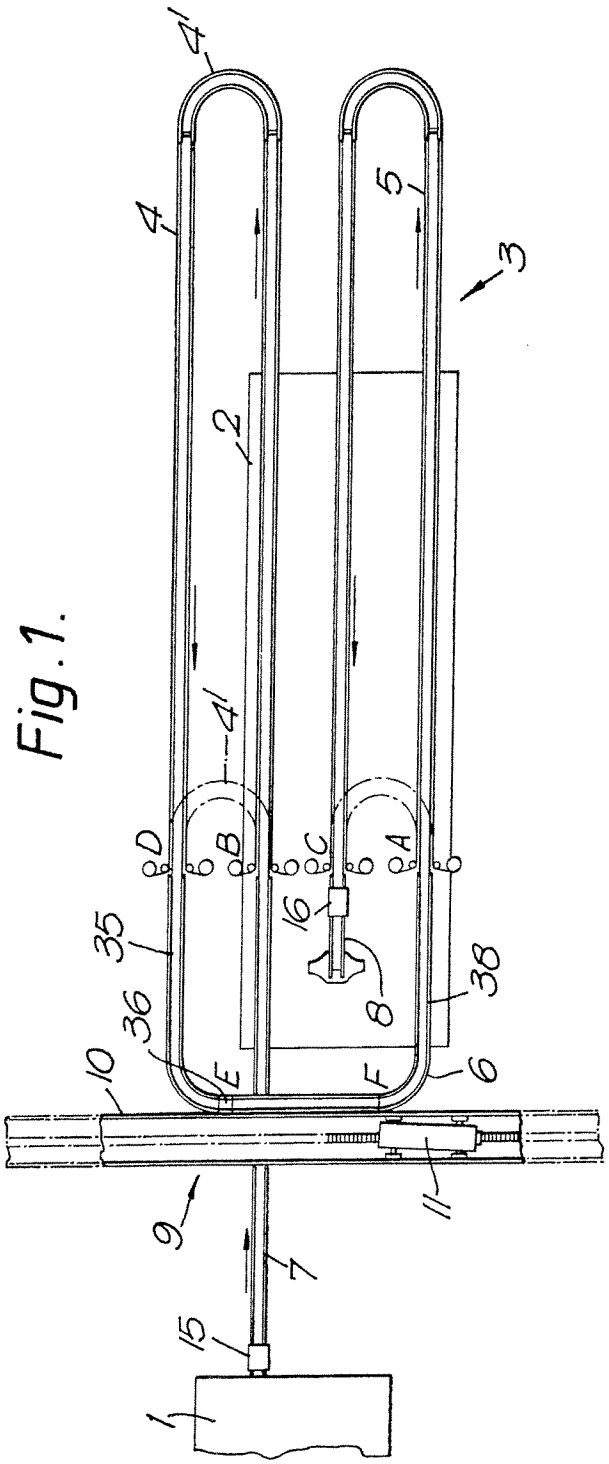

Fig. 2.

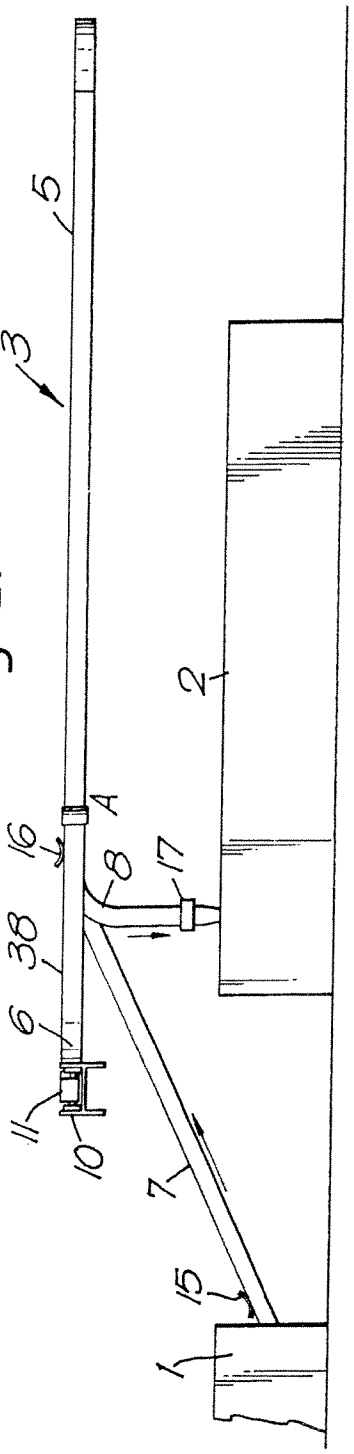

Fig.3.

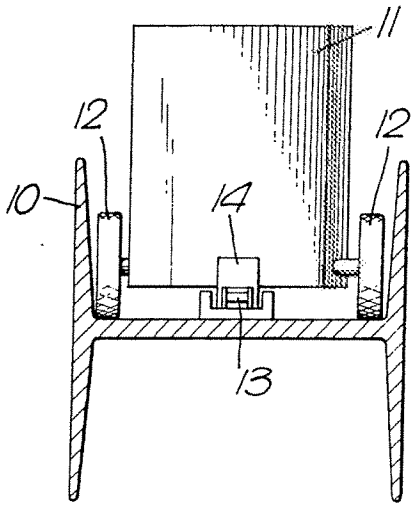

Fig.4.

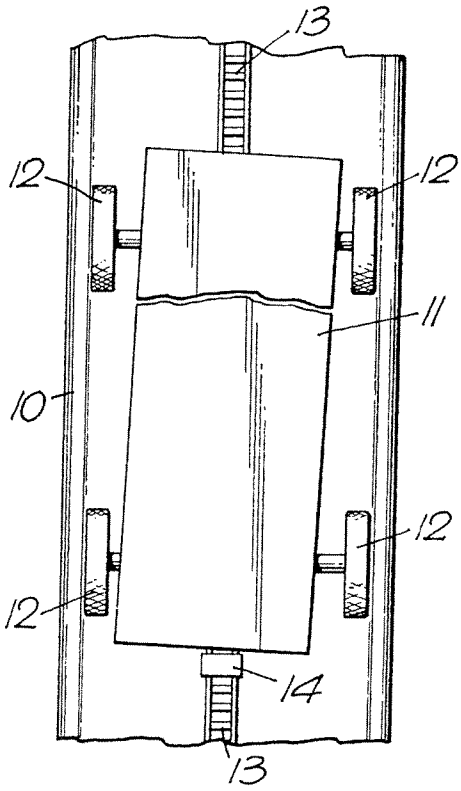

Fig.5.

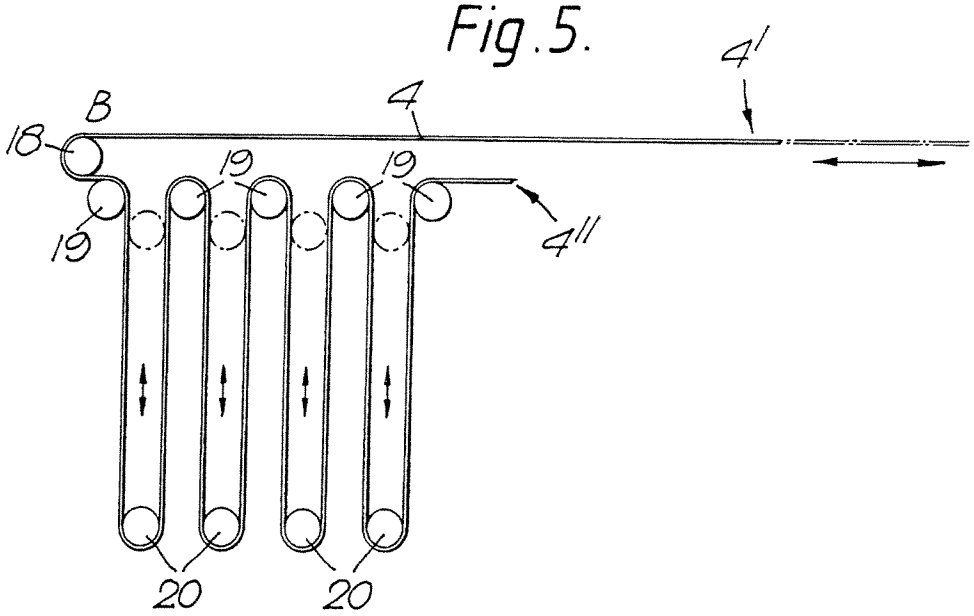

Fig.6.

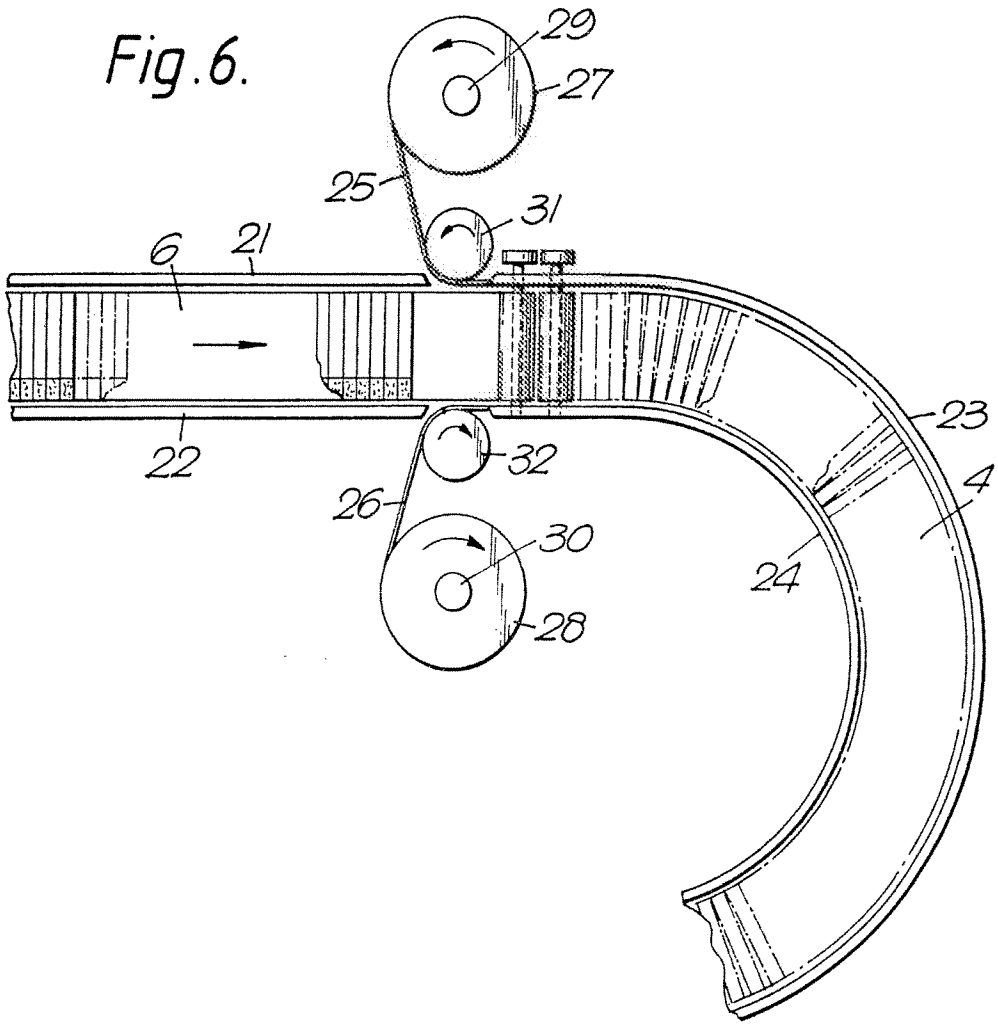

Fig.7.

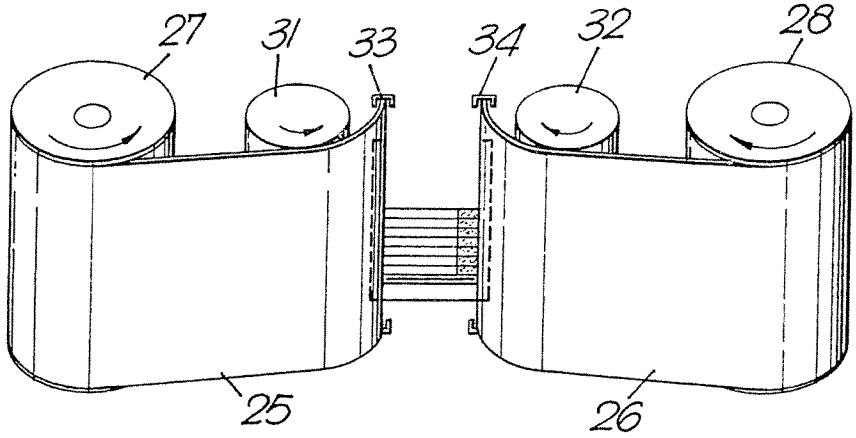

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Fig.8.

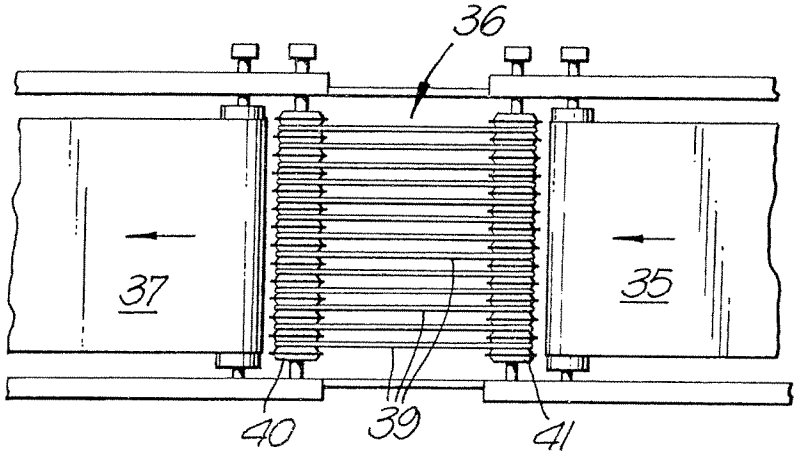

Fig.9.

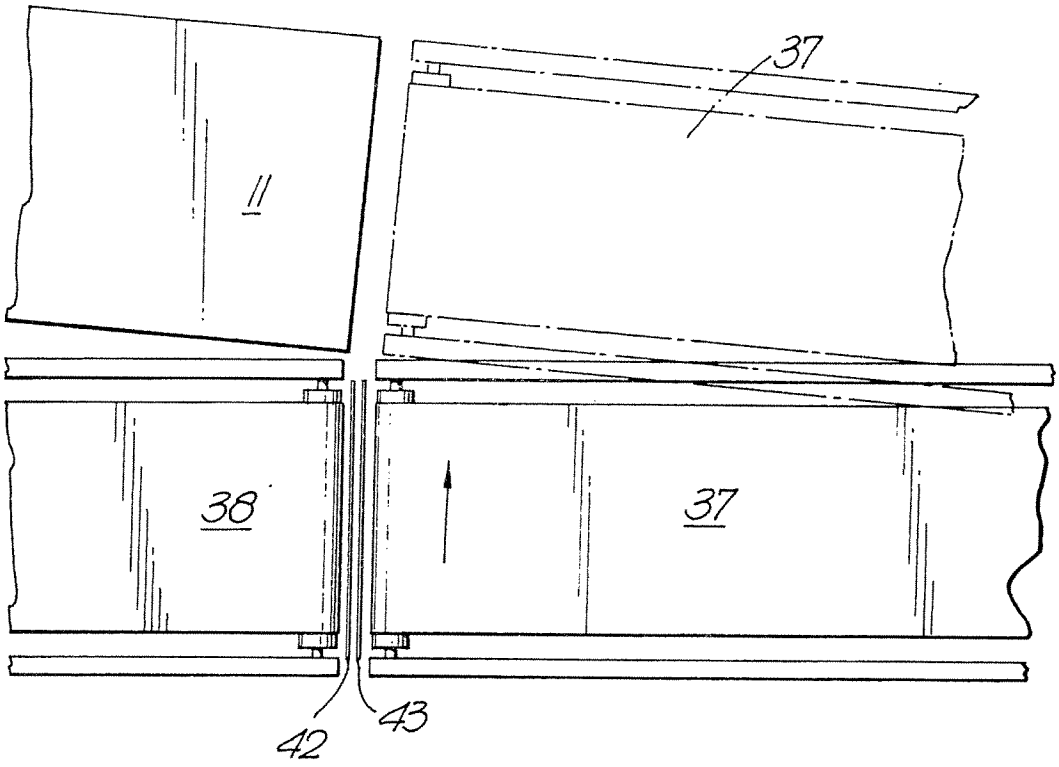

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Fig.10a.

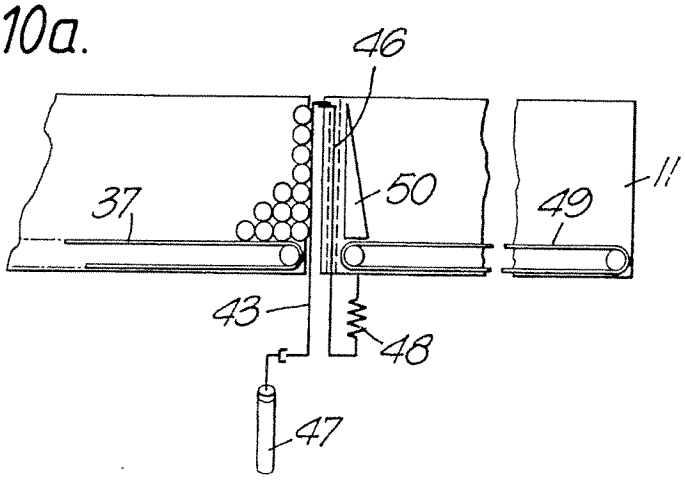


Fig.10b.

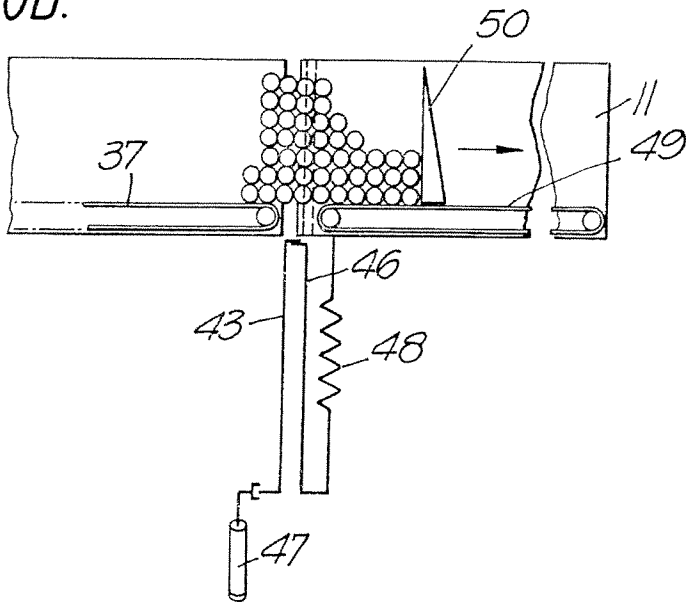
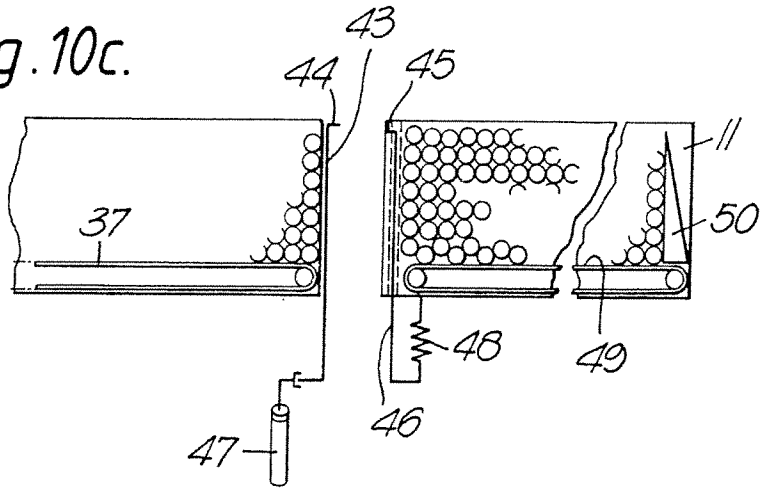


Fig.10c.



SPECIFICATION

Rod-like article conveying and storage system

This invention relates to rod-like article conveying and storage systems.

It is a common practice in the cigarette making industry to convey cigarettes from a cigarette making machine to a cigarette packing machine via a conveying and storage system. The conveying and storage systems provides a reservoir facility which permits continued operation of one of the machines in the event that the other stops.

The present invention provides a rod-like article conveying and storage system comprising first and second conveyor means operable to convey rod-like articles transversely of the longitudinal axes thereof, each of the said first and second conveyor means being capable of holding a variable number of rod-like articles, independently of variation in the number of rod-like articles held in the other conveyor means, rod-like article transport means, and rod-like article transfer means intermediate said first and second conveyor means operable to transfer rod-like articles between one of said first and second conveyor means and said transport means, the arrangement being such that during periods when said transfer means is not operating, rod-like articles may pass from one to the other of said first and second conveyor means.

Preferably, the conveying and storage system comprises third conveyor means operable to convey rod-like articles transversely of the longitudinal axes thereof from one of the first and second conveyor means to the other, and the transfer means is at the third conveyor means.

Variation in the capacity of each of the first and second conveyor means may be obtained by varying the conveying path length thereof. Alternatively, the capacity of each of the first and second conveyor means may be fixed, but a variable proportion of that capacity be occupied by rod-like articles. A cigarette storage conveyor operating in accordance with the latter principle is described in United Kingdom Patent Specification No. 1,299,174.

Preferably, one or each of the first and second conveyor means is operable to convey rod-like articles from an inlet to an outlet of the conveyor means. Less preferably, one or each of the first and second conveyor means comprises a single port which serves as both an inlet and an outlet.

The transport means advantageously comprises one or more carriage means operable to carry batches of rod-like articles along a path defined by guide means. An alternative form of transport means comprises conveyor means operable to convey a bed of rod-like articles.

The transport and transfer means may be operable for transfer of rod-like articles in a direction to or from the first conveyor means and/or in a direction to or from the second conveyor means.

If a third conveyor means is provided, the transfer means advantageously comprises a portion of the third conveyor means which may be moved out of alignment with the remainder of the third conveyor means. Alternatively, the transfer means may comprise a conveying path, a down-drop conveyor or chute for example, permanently extending from the third conveyor means.

The rod-like article conveying and storage system suitably comprises control means operable to cause variation in the number of rod-like articles held by the first and second conveyor means in relation to the prevailing feed rate of articles to the first conveyor means and the rate of demand for the articles from the second conveyor means. Advantageously, the control means is operable to control the rod-like article holding levels of the first and second conveyor means such as to maintain the articles in a bed of substantially constant height.

In order that the invention may be clearly understood and readily carried into effect, reference will now be made, by way of example, to the diagrammatic drawings hereof, in which:-

Figure 1 shows, in plan view, a cigarette conveying and storage system in association with a cigarette making machine and a cigarette packing machine;

Figure 2 shows a side elevation of what is shown in Figure 1;

Figure 3 shows an end view of a shuttle carriage and, in cross-section, a shuttle carriage track of the conveying and storage system;

Figure 4 shows a plan view of the shuttle carriage of Figure 3;

Figure 5 shows, in side elevation, part of a conveyor of the conveying and storage system;

Figure 6 shows, in plan view, parts of the conveyor shown in Figure 5;

Figure 7 shows a view of the conveyor of Figures 5 and 6 looking in the direction of the broad arrow on Figure 6;

Figure 8 shows, in plan view, a hingeable conveyor length and parts of adjacent conveyor lengths of the conveying and storage system;

Figure 9 shows, in plan view, the shuttle carriage of Figures 3 and 4 positioned adjacent a conveyor length which extends from the hingeable conveyor length of Figure 8; and

Figures 10a-b show stages in the operation of the shuttle carriage of Figures 3 and 4.

In Figures 1 and 2, reference numerals 1 and 2 designate respectively a cigarette making machine and a cigarette packing machine. Reference numeral 3 designates a cigarette conveying and storage system.

The cigarette conveying and storage system 3 comprises a first, U-form conveyor 4 extending between fixed locations B and D, a second, U-form conveyor 5 extending between fixed locations A and C, and a

third conveyor 6 extending between locations A and D. An upwardly inclined conveyor 7 is operable to feed cagarettes from the making machine 1 to the first conveyor 4 at the location B. Positively driven down-drop conveyor 8 extends downwardly from the second conveyor 5, at location C, to the packing machine 2.

A cigarette transport means 9 comprises a track 10 of I-section (see Figure 3) and a shuttle carriage 11 mounted on freely rotatable wheels 12. The track 10 serves to support and guide the shuttle carriage 11 in the movement thereof between a position adjacent the third conveyor 6, as shown in Figure 1, and at least one further cigarette conveying and storage system, similar to the system 3, associated with a further making and packing machine group. The shuttle carriage 11 may be driven along the track 10 by means of a reversible drive chain 13 with which a dog 14 secured to the carriage 11 engages. As may be seen from Figure 4, the longitudinal axis of the shuttle carriage 11 is offset relative to the axis of the track 10. The purpose of this offset will become clear from the description hereinafter of the operation of the transport means 9.

Reference numerals 15 and 16 designate cigarette bed height control monitors. Reference numeral 17 designates a cigarette bed density control monitor.

The U-form conveyor 4 is an endless conveyor and passes about a pulley at each of the locations B and D. Because of the bend (designated 4') at the outer end of the conveyor 4, the conveyor must be of a construction which permits lateral bending. A suitable form of conveyor which permits lateral bending is described in United Kingdom Patent Specifiction No. 1,251,217.

Figure 5 is a side elevation showing the first limb of conveyor 4, i.e. that limb which extends from location B. The above mentioned pulley about which the conveyor 4 passes at location B is designated 18. The pulley 18 and the corresponding pulley at location D are driven by individual, variable speed, reversible motors (not shown), each of these two motors being speed variable independently of the other. As may be seen from Figure 5, the lower run of the first limb of the conveyor extends about a system of fixed pulleys 19 and moveable pulleys 20. An exactly similar system of fixed and moveable pulleys is associated with the second limb of the conveyor 4, i.e. that limb which extends from location D. At the point designated 4" in Figure 5, the conveyor 4 passes in a direction inwardly of the plane of the drawing to a corresponding point of the second limb. The provision of the two systems of pulleys in the region of the locations B and D permits the conveyor 4, while conveying cigarettes in the direction of the arrows, to be extended and contracted between an outermost and an innermost position of the bend 4'. The outermost and an innermost position of the bend 4' is indicated in broken line. The conveyor 4 in its fully extended condition may hold, for example, 50,000 more cigarettes that when it is in its fully contracted condition.

The construction of the conveyor 5 is similar to that of the conveyor 4 and thus it can be extended and contracted in the same manner in order to vary its cigarette storage capacity while being driven to convey cigarettes in the direction of the arrows.

Since it is possible with each of the conveyors 4 and 5 both to move the other bend thereof between inner and outer positions and also to drive the motors at the inner ends D, B and C, A at independently variable speeds, it is possible with each of these conveyors to have the outer bend moving while the speeds of the inner end motors of the conveyor are equal or different. When the speed of a motor is zero, the conveyor is referred to hereinafter as being anchored at the location of that motor.

The conveyors 6 and 7 are provided with fixed side wall members, parts of those of conveyor 6 being shown in Figure 6 and being designated 21 and 22. The conveyors 4 and 5 are provided with fixed curved side walls, those of conveyor 4 being designated 23 and 24 in Figure 6. The conveyor 4 as shown in Figure 6 is in its fully retracted condition. As the conveyor 4 is extended, two lengths of belting 25 and 26, leading ends of which are secured to the side walls 23 and 24 respectively, are drawn from reels 27 and 28 mounted on bobbins 29 and 30. The lengths of belting 25 and 26 are trained about rollers 31 and 32 and pass through guide members 33 and 34 (see Figure 7). The belting 25, 26 is of a material which is flexible in the direction necessary for it to be reeled on the bobbins 29, 30, but in a direction perpendicular to the first it is of a stiffbess adequate for the provision of cigarette restraining side walls for the straight run of conveyor 4 which extends from location D.

The bobbins 29, 30 are each resiliently biased in the reeling up direction so that when after the conveyor 4 has been extended, it is contracted, the belting 25, 26 is re-reeled.

Pairs of side walls are provided in exactly similar manner for the straight run of conveyor 4 which extends from location B and also for the straight runs of conveyor 5 which extend from the locations A and C.

The conveyor 6 is comprised of four conveyor lengths, namely a length 35 extending between location D and a location E, a short length 37 at location E, a length 36 extending from location E to a location F and a length 38 extending from location F to location A. Conveyor lengths 35 and 38 are of similar form to conveyors 4 and 5 in that they may extend through lateral curves. Conveyor length 37 may be of plain band form. The conveyor length 37 is swingable laterally to a position in which it is aligned with the shuttle carriage 11. This position of conveyor length 37 is indicated in broken line in Figure 9. The conveyor length 36 is of a form which provides a hinge for the conveyor length 37. The conveyor length 36 comprises a plurality of O-section, extendible, polyurethane belts 39 mounted on grooved rollers 40, 41 (see Figure 8). The hinge rotation point is outside of the conveyor 36 and thus all of the belts 39 are

maintained in tension during hinging. Side walls 42, 43 at the location of the conveyor 36 are of flexible sheet material, spring steel for example. All of the conveyor lengths 35-38 of the conveyor 6 are reversible, i.e. they may be run in the direction A to F to E to D.

When both the making machine 1 and the packing machine 2 are running, cigarettes are conveyed in turn by conveyors 7, 4, 6, 5 and 8 from the making machine 1 to the packing machine 2. Differences in the rate of production of cigarettes by the making machine 1 and the rate at which cigarettes are demanded by the packing machine 2 can be accommodated by the extension or contraction of the conveyors 4, 5 to vary the cigarette storage capacity thereof. Thus, for example, should the making machine output rate exceed the packing machine consumption rate, then under the control action of a central control unit (not shown) the conveyor 5 is extended. The control parameter is the height of the bed of cigarettes and the control unit acts to maintain the bed at a nominal height of, for example, 200 mm. Bed height indicative signals pass to the control unit from the bed height control monitors 15, 16. If the same imbalance in making and packing rates persists when the conveyor 5 has been extended to its maximum extent, the control unit causes the conveyor 4 to extend, again maintaining the bed height at the nominal value.

Should the making machine 1 stop while the packing machine 2 continues to run, the control unit causes the conveyor 4 to contract with the end thereof at location B being anchored. The contraction movement of the limb of conveyor 4 extending to location D causes cigarettes to be fed to the conveyor 6 and thence via conveyor 5 to conveyor 8. If by the time that the conveyor 4 has been fully retracted the making machine 1 has not been restarted, conveyor 5 is caused to be contracted with anchoring at A, the conveyors 4 and 6 being stationary.

Should the packing machine 2 stop while the making machine 1 continues to run, the conveyor 5 is extended with anchoring at location C. If the conveyor 5 becomes fully extended before the packing machine 2 is restarted, drive to conveyor 6 is discontinued and the conveyor 4 is extended with anchoring at location D.

The purpose of the transport system 9 is to feed additional cigarettes into the conveyor 4 when the store of cigarettes on the conveyors 4 and 5 has fallen to a preset limit value, and to remove cigarettes form the conveyor 4 when the maximum limit value capacity of the conveyors 4 and 5 has been approached or to transfer cigarettes to or from conveyor 4 when high or low limit values respectively obtain in a store in another conveying and storage system associated with another maker/packer group.

The operation of the transport system 9 with both the making machine 1 and the packing machine 2 running will now be described with reference to Figures 9 and 10. When the shuttle carriage 11 has been moved along the track 10 to the position as shown in Figure 9 and the control unit initiates a cigarette transfer to the shuttle carriage 11, gates 42 and 43, sliably mounted on conveyor lengths 38 and 37 respectively, are moved upwardly between conveyor lengths 37 and 38 and divide the bed of cigarettes thereon. In order that the gates 42, 43 enter a stationary bed, conveying drive to conveyor 6 is discontinued. Cigarettes are fed to the down-drop conveyor 8 by the contraction of conveyor 5 with anchoring at location A. Conveyor 4 extends anchored at D. The conveyor length 37 is swung to the position thereof indicated in broken line in Figure 9, whereupon the gate 43 is lowered. A projection 44 at the upper end of the gate 43 overlies a similar projection 45 at the upper end of a gate 46 which is slidably mounted at the inlet end of the shuttle carriage 11. Movement of the gate 43 is produced under the action of a pneumatic cylinder and piston unit 47 mounted on conveyor length 37. When the gate 44 is moved downwardly the co-operation of the projections 44 and 45 cause the gate 46 too to be lowered against the force of a spring 48 which urges the gate 46 upwardly. When both of the gates 43, 46 have been fully lowered, drive to the conveyor lengths 35-37 is resumed and cigarettes are transferred from conveyor length 37 into the shuttle carriage 11. The cigarettes are supported in the carriage 11 upon a conveyor 49 on the upper run of which is secured an upwardly extending stop member 50. The conveyor 49 is driven, at the same speed as the conveyor length 37, via a dog clutch connection (not shown) with the drive means (also not shown) of the conveyor length 37. The stop member 50 serves to support the leading end of the batch of cigarettes as they enter the shuttle carriage 11 (Figure 10b). The batch may comprise, for example, 10,000 cigarettes. When the shuttle carriage has had transferred to it the whole of the cigarette batch, the drive to the conveyor lengths 35-37 is again discontinued and the unit 47 drives the gate 43 upwards again. This permits the gate 46 too to resume its upper position. Thus the cigarette batch is contained between the gate 46 and the stop member 50 and the shuttle carriage can be moved away from the conveyor length 37 (see Figure 10c).

The transfer sequence is completed by the conveyor length 37 being swung back into alignment with conveyor length 38 and the gate 43 being lowered. The gate 42 is spring urged upwardly similarly to the gate 46 and when the gate 43 is lowered, the projection 44 thereon co-operates with a projection (not shown) on the gate 42 and thus the gate 42 too is caused to be lowered against the spring force. Conveying drive to the conveyor lengths 35-38 is then resumed.

A similar transfer sequence takes place when it is required to transfer a batch of cigarettes from the shuttle carriage 11 into the conveyor 4, although in this case the conveyor 49 and the conveyor lengths 35-36 are run in the reverse direction. During the transfer the conveyor 4 is extended with no anchoring at B or D. The rate of transfer of cigarettes from the carriage 11 may be regulated to equal the cigarette infeed rate from the making machine 1.

Six further modes of operation of the cigarette conveying and storage system 3 will now be described. In the descriptions of these modes the following abbreviations will be used:-

M = making machine 1
P = packing machine 2
S = shuttle carriage 11
MC = maker conveyor, i.e. conveyor 4
PC = packer conveyor, i.e. conveyor 5
SC = shuttle conveyor, i.e. conveyor 49 plus conveyor lengths 35-37

Mode 1

M - running
P - stopped
S - transferring in
SC - reversed
MC - extends
PC - stationary

Mode 2

M - stopped
P - running
S - transferring in
SC - reversed
MC - extends anchored at B
PC - contracts anchored at A

Mode 3

M - stopped
P - stopped
S - transferring in
SC - reversed
MC - extends anchored at B
PC - stationary

Mode 4

M - running
P - stopped
S - transferring out
SC runs forwards
MC - runs forwards
PC - stationary

Mode 5

M - stopped
P - running
S - transferring out
SC - runs forwards
MC - contracts anchored at B
PC - contracts anchored at A

Mode 6

M - stopped
P - stopped
S - transferring out
SC - runs forwards
MC - contracts anchored at B
PC - stationary

When a plurality of maker/packer groups, each being associated with its own conveying and storage system the same as the system 3, are interconnected by a transport means comprising a track, as track 10, and one or more shuttle carriages, as carriage 11, the total cigarette storage capacity of all of the conveying and storage systems does not need to be so large as the total storage capacity required if each group is associated with a storage means which is not interconnected with any of the other storage means.

When a plurality of shuttle carriages are used with a track serving to interconnect a plurality of conveying and storage systems, the track may include passing loops whereby a carriage may pass another.

Numerous modifictions of the above described conveying and storage system 3 are possible without departure from the underlying inventive concept. Some such modifications are as follows.

It could be arranged for a shuttle carriage to transfer cigarettes to and/or from the second extendible conveyor, i.e. conveyor 5.

The or each shuttle carriage may be constructed to permit transfer in and/or out at both ends thereof. The or each shuttle carriage may comprise an articulation joint to facilitate travel of the carriage through tight curves in the track.

The first and second extendible conveyors may be disposed other than side-by-side and may extend other than horizontally. One or both of the extendible conveyors could be in the form of a double helix of variable diameter.

Whereas as above described, for each of the conveyors 4 and 5 the endless conveyor extends in a run directly between the pulley systems at the respective inner ends of the conveyor, it could alternatively be arranged that the conveyor passed from one pulley system to the other via a bend, stationary in space, at a location distant the pulley systems to the right as viewing Figure 1. A further alternative arrangement disposes of the pulley systems, the lower run of the endless conveyor extending around a bend which moves in the opposite direction to the upper bend (4' for conveyor 4).

Advantageously, bed height sensors may be positioned at each of the locations A-D and signals from the sensors utilized for controlling the speeds of the variable speed motors at those locations.

CLAIMS

1. A rod-like article conveying and storage system comprising first and second conveyor means operable to convey rod-like articles transversely of the longitudinal axes thereof, each of said first and second conveyor means being capable of holding a variable number of rod-like articles, independently of variation in the number of rod-like articles held in the other conveyor means, rod-like article transport means, and rod-like article transfer means intermediate said first and second conveyor means operable to transfer rod-like articles between one of said first and second conveyor means and said transport means, the arrangement being such that during periods when said transfer means is not operating, rod-like articles may pass from one to the other of said first and second conveyor means.

2. A system as claimed in Claim 1, and further comprising third conveyor means operable to convey rod-like articles transversely of the longitudinal axes thereof from one of said first and second conveyor means to the other.

3. A system as claimed in Claim 2, wherein said transfer means is at said third conveyor means.

4. A system as claimed in Claim 3, wherein said transfer means comprises a portion of said third conveyor means, said portion being swingable out of alignment with the remainder of said third conveyor means.

5. A system as claimed in any one of the preceding claims, wherein the conveying path length of each of said first and second conveyor means is variable.

6. A system as claimed in any one of the preceding claims, wherein each of said first and second conveyor means is operable to convey rod-like articles from an inlet to an outlet of the conveyor means.

7. A system as claimed in Claim 6 as appended to Claim 5, wherein for each of said first and second conveyor means said inlet is at a first fixed location and said outlet is at a second fixed location and the conveying path length of the conveyor means may be varied by extension or contraction relative to one of said inlet and said outlet without the simultaneous occurrence of extension or contraction of said path length relative to the other of said inlet and said outlet.

8. A system as claimed in any one of the preceding claims, wherein said transport means comprises carriage means operable to carry batches of rod-like articles along a path defined by guide means.

9. A system as claimed in any one of the preceding claims, wherein said transfer means is operable to transfer rod-like articles in a direction to or from said first conveyor means.

10. A system as claimed in any one of the preceding claims, wherein said transfer means is operable to transfer rod-like articles in a direction to or from said second conveyor means.

11. A system as claimed in any one of the preceding claims, and further comprising control means operable to cause variation in the conveying path lengths of said first and second conveyor means in relation to the prevailing feed rate of rod-like articles to said first conveyor means and the rate of demand for said articles from said second conveyor means.

12. A system as claimed in Claim 11, wherein said control means is responsive to signals indicative of the bed height of said rod-like articles.

13. A system as claimed in any one of the preceding claims, said system being associated with a cigarette making machine and a cigarette packing machine, said first conveyor means being connected to said cigarette making machine for receiving cigarettes therefrom and said second conveyor means being connected to said cigarette packing machine for feeding cigarettes thereto.

14. A rod-like article conveying and storage system substantially as described hereinabove with reference to the accompanying drawings.

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